



pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Science Item and Scoring Sampler



2017–2018
Grade 8

Pennsylvania Department of Education Bureau of Curriculum, Assessment and Instruction—September 2017

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INTRODUCTION

The Pennsylvania Department of Education provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Academic Standards (PAS). In addition to the PAS, these tools include Assessment Anchor documents, assessment handbooks, and content-based item and scoring samplers. Each Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing local instructional programs and can also be useful in preparing students for the statewide assessment.

This Item and Scoring Sampler is available in Braille format. For more information regarding Braille, call (717)-901-2238.

WHAT IS INCLUDED

This sampler contains test questions, or test “items,” that have been written to align to the Assessment Anchors that are based on the PAS. The sample test questions model the types of items that will appear on an operational PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors prior to being piloted in an embedded field test within a PSSA assessment and then used operationally on a PSSA assessment. Answer keys, scoring guidelines, and any related stimulus material are also included. Additionally, sample student responses are provided with each open-ended item to demonstrate the range of responses that students provided in response to these items.

PURPOSES AND USES

The items in this sampler may be used as models for creating assessment items at the classroom level, and they may also be copied and used as part of a local instructional program.¹ Classroom teachers may find it beneficial to have students respond to the open-ended items in this sampler. Educators can then use the item’s scoring guideline and sample responses as a basic guide to score the responses, either independently or together with colleagues within a school or district. The sampler also includes the *General Description of Scoring Guidelines for Science Open-Ended Items* used to develop the item-specific guidelines. The general description of scoring guidelines can be used if any additional item-specific scoring guidelines are created for use within local instructional programs.¹

ITEM FORMAT AND SCORING GUIDELINES

The multiple-choice (MC) questions have four answer choices. Each correct response to an MC question is worth one point.

Each open-ended (OE) item in science is scored using an item-specific scoring guideline based on a 0–2 point scale.

TESTING TIME AND MODE OF TESTING DELIVERY FOR THE PSSA

The PSSA is delivered in traditional paper-and-pencil format as well as in an online format. The estimated time to respond to a test question is the same for both methods of test delivery. During an official testing administration, students are given additional time as necessary to complete the test questions. The following table shows the estimated response time per item for each item type.

Science Item Type	MC	OE
Estimated Response Time (minutes)	1	5

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ITEM AND SCORING SAMPLER FORMAT

This sampler includes the test directions and scoring guidelines that appear in the PSSA science assessments. Each sample multiple-choice question is followed by a table that includes the alignment, the answer key, the depth of knowledge (DOK) level, the percentage² of students who chose each answer option, and a brief answer-option analysis or rationale. Each open-ended item is followed by a table that includes the item alignment, DOK, and mean student score. Additionally, each of the included item-specific scoring guidelines is combined with sample student responses representing each score point to form a practical, item-specific scoring guide. The *General Description of Scoring Guidelines for Science Open-Ended Items* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs.

Example Multiple-Choice Question Information Table

Item Information	
Alignment	Assigned AAEC
Answer Key	Correct Answer
Depth of Knowledge	Assigned DOK
p-value A	Percentage of students who selected option A
p-value B	Percentage of students who selected option B
p-value C	Percentage of students who selected option C
p-value D	Percentage of students who selected option D
Option Annotations	Brief answer-option analysis or rationale

Example Open-Ended Item Information Table

Alignment	Assigned AAEC	Depth of Knowledge	Assigned DOK	Mean Score	
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² All p-value percentages listed in the item information tables have been rounded.

SCIENCE TEST DIRECTIONS

On the following pages are the Science questions. There are two types of questions.

Multiple-Choice Questions:

Some questions will ask you to select an answer from among four choices. These questions will be found in your test booklet.

For the multiple-choice questions:

- Read each question, and choose the best answer.
- Record your choice in the answer booklet.
- Only one of the answers provided is the correct response.

Open-Ended Questions:

Other questions will require you to write your response. These questions will be found in your answer booklet.

For the open-ended questions:

- Be sure to read the directions carefully.
- If the question asks you to do two tasks, be sure to complete both tasks.
- If the question asks you to compare, be sure to compare. Also, if the question asks you to explain, describe, or identify, be sure to explain, describe, or identify.

GENERAL DESCRIPTION OF SCORING GUIDELINES FOR SCIENCE OPEN-ENDED ITEMS**2 Points**

- The response demonstrates a *thorough* understanding of the scientific content, concepts, and procedures required by the task(s).
- The response provides a clear, complete, and correct response as required by the task(s). The response may contain a minor blemish or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

1 Point

- The response demonstrates a *partial* understanding of the scientific content, concepts, and procedures required by the task(s).
- The response is somewhat correct with *partial* understanding of the required scientific content, concepts, and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

0 Points

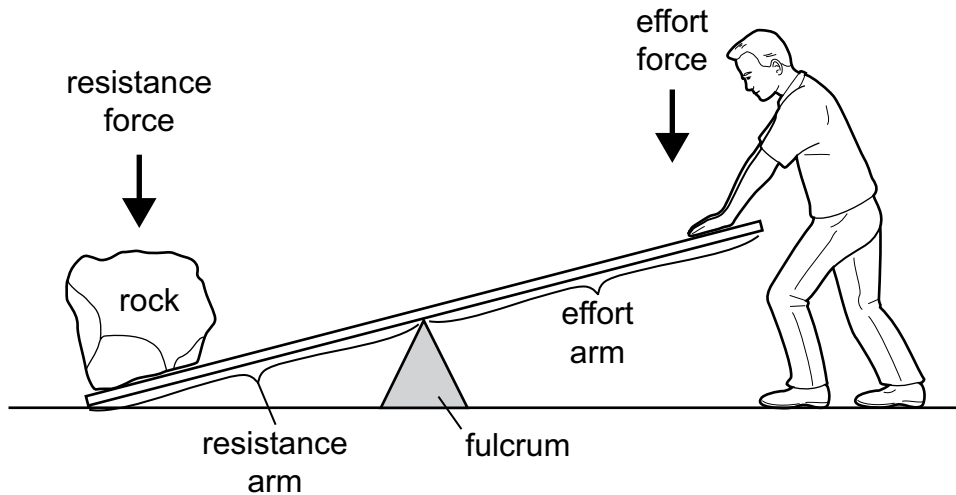
- The response provides *insufficient* evidence to demonstrate any understanding of the scientific content, concepts, and procedures as required by the task(s) for that grade level.
- The response may show only information copied or rephrased from the question or *insufficient* correct information to receive a score of 1.

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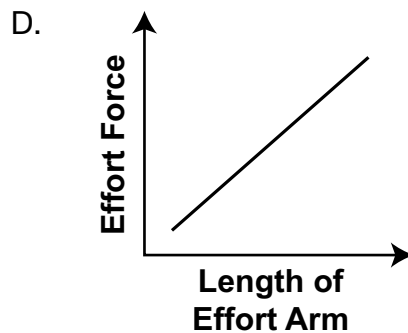
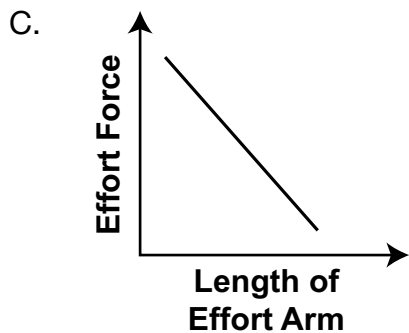
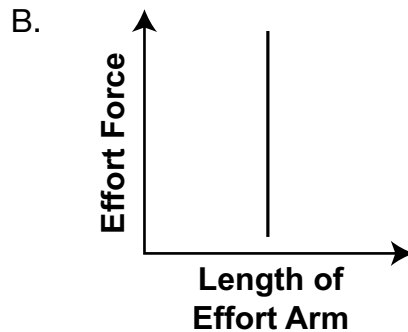
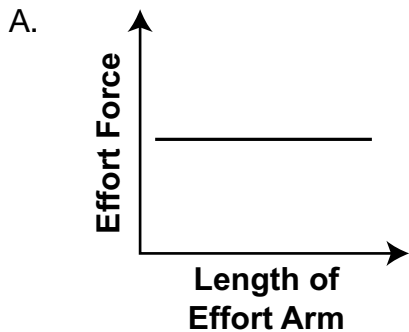
MULTIPLE-CHOICE QUESTIONS

1. Use the drawing below to answer the question.

Student Using a Lever



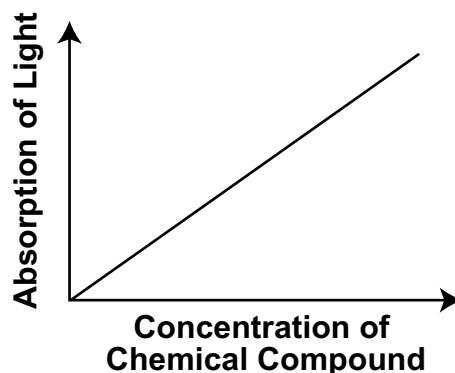
A student was unable to lift a rock using the lever setup shown. The student moved the location of the fulcrum closer to the rock until he was able to lift the rock. The student concluded that as the length of the effort arm increased, less effort force was needed to lift the rock. Which graph **best** represents the student's conclusion?



Item Information	
Alignment	S8.A.1.1.4
Answer Key	C
Depth of Knowledge	2
p-value A	7%
p-value B	4%
p-value C	55% (correct answer)
p-value D	34%
Option Annotations	<p>A. This graph shows that as the length of the effort arm increases, effort force remains the same.</p> <p>B. This graph shows how effort force changes as the length of the effort arm remains the same.</p> <p>C. Key: This graph shows that as the length of the effort arm increases, effort force decreases.</p> <p>D. This graph shows effort force increasing as the length of the effort arm increases.</p>

2. Use the graph below to answer the question.

Light Absorption vs. Concentration



A scientific technique can be used to determine the presence and concentration of a chemical compound in a sample. A light source is directed at samples of known concentrations and the amount of light each absorbs is measured. Based on the graph, which statement **best** describes the relationship between concentration and light absorption?

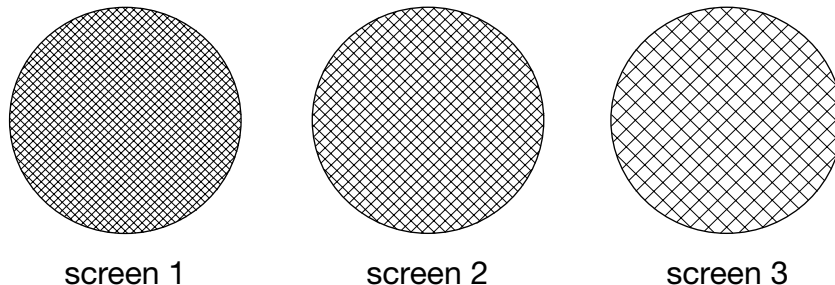
- A. The light absorption of a sample is independent of the concentration of the chemical compound.
- B. The concentration of the chemical compound in a sample remains steady as the light absorption increases.
- C. An increase in the concentration of the chemical compound in a sample is accompanied by an increase in the light absorption.
- D. A decrease in the light absorption of a sample is accompanied by an increase in the concentration of the chemical compound.

Item Information	
Alignment	S8.A.2.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	11%
p-value B	20%
p-value C	62% (correct answer)
p-value D	7%
Option Annotations	<p>A. The graph shows that light absorption depends on chemical concentration.</p> <p>B. Light absorption changes relative to chemical concentration.</p> <p>C. Key: This graph shows a direct relationship in which light absorption increases in response to an increase in chemical concentration.</p> <p>D. Light absorption increases as the chemical concentration increases.</p>

3. Which statement **best** describes the mass of an apple?
- A. Mass is the amount of matter in the apple.
 - B. Mass is the amount of space the apple occupies.
 - C. Mass is the force applied to the apple by another object.
 - D. Mass is the measure of the apple’s ability to resist changes in motion.

Item Information	
Alignment	S8.A.2.1.2
Answer Key	A
Depth of Knowledge	1
p-value A	59% (correct answer)
p-value B	27%
p-value C	7%
p-value D	7%
Option Annotations	<p>A. Key: Mass describes the amount of matter in an apple.</p> <p>B. Volume describes the amount of space an apple occupies.</p> <p>C. An applied force is the force applied to the apple by another object.</p> <p>D. Inertia is the measure of an apple’s ability to resist changes in motion, which varies with mass.</p>

4. Use the drawings and the table below to answer the question.



Investigation Setup

Soil Sample	Screen Used
X	screen 3
Y	screen 1
Z	screen 2

A student used the smallest screen that could be used to completely sift the soil sample. Which conclusion **best** matches the student’s investigation?

- A. Soil sample X has the most uniform particle size.
- B. Soil sample Y has the smallest average particle size.
- C. Soil samples Y and Z are most similar in size.
- D. Soil samples X and Y are most similar in size.

Item Information	
Alignment	S8.A.2.1.5
Answer Key	B
Depth of Knowledge	2
p-value A	9%
p-value B	71% (correct answer)
p-value C	16%
p-value D	4%
Option Annotations	A. Sample X has the largest average particle size. B. Key: Soil sample Y has the smallest average particle size because it was completely sifted through the smallest screen. C. Soil samples Y and Z are no more similar than soil samples X and Z. D. Soil samples X and Y are least similar in size.

5. Which unit should a student use when measuring the change in the amount of space taken up by a liquid as it is heated?
- A. g
 - B. °C
 - C. mL
 - D. mm

Item Information	
Alignment	S8.A.2.2.2
Answer Key	C
Depth of Knowledge	2
p-value A	9%
p-value B	17%
p-value C	65% (correct answer)
p-value D	9%
Option Annotations	<p>A. Grams are used to measure mass, not volume.</p> <p>B. Degrees Celsius are used to measure temperature, not volume.</p> <p>C. Key: Milliliters are used to measure volume, which is the amount of space occupied by matter.</p> <p>D. Millimeters are used to measure length, not volume.</p>

6. An engineering team developed a new airplane body design that uses less fuel while flying. The team built a model to test the new design. How does using a model **most likely** help the engineering team?
- A. It can be tested and changed more easily than a real airplane.
 - B. It allows them to safely fly an airplane in dangerous conditions.
 - C. It can be made to higher quality standards than a real airplane.
 - D. It allows them to save money by never test-flying a full-size airplane.

Item Information	
Alignment	S8.A.3.2.2
Answer Key	A
Depth of Knowledge	2
p-value A	63% (correct answer)
p-value B	11%
p-value C	10%
p-value D	16%
Option Annotations	<p>A. Key: Models can be used to test designs at lower costs and at smaller scales.</p> <p>B. Using models allows engineers to simulate danger without risking an airplane.</p> <p>C. Using models helps engineers determine the quality standards required in a real airplane.</p> <p>D. Successful testing of models is followed by tests of full-size airplanes.</p>

7. Use the data table below to answer the question.

Information about Several Gases

Gas	Argon (Ar)	Fluorine (F ₂)	Hydrochloric Acid (HCl)	Oxygen (O ₂)
Color	colorless	pale yellow	colorless	colorless
Density (g/L) at 20°C	1.66	1.58	1.52	1.33
Boiling Point (°C)	-186	-188	-85	-183
Reaction with Sodium (Na) Metal	none	very rapid	very rapid	very rapid

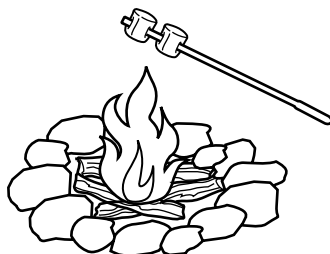
A scientist examined a colorless gas, which had a density between 1.30 and 1.60 g/L and a boiling point between -190 and -180°C. The gas reacted with sodium (Na) metal. Based on the data in the table, what is the **most likely** identity of the gas?

- A. argon (Ar)
- B. fluorine (F₂)
- C. hydrochloric acid (HCl)
- D. oxygen (O₂)

Item Information	
Alignment	S8.C.1.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	9%
p-value B	14%
p-value C	13%
p-value D	64% (correct answer)
Option Annotations	A. Unlike the test gas, argon is unreactive with sodium (Na) metal. B. Unlike the colorless test gas, fluorine is pale yellow. C. Unlike the test gas, hydrochloric acid has a boiling point of -85 degrees Celsius. D. Key: The characteristics of oxygen match the characteristics of the test gas.

8. Use the drawing below to answer the question.

Roasting Marshmallows



A student is roasting marshmallows on a stick above the flames of a campfire. How does convection transfer heat from the fire to the marshmallows?

- A. by direct contact between the fire and the marshmallows
- B. by currents of warm air molecules flowing upward from the fire
- C. by the collision of warm air and cool air molecules above the fire
- D. by the movement of heat through empty spaces between air molecules

Item Information	
Alignment	S8.C.2.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	12%
p-value B	68% (correct answer)
p-value C	7%
p-value D	13%
Option Annotations	<p>A. Heat transfer involving direct contact between molecules is conduction.</p> <p>B. Key: Transfer of energy occurs by convection when heated air molecules move due to density.</p> <p>C. Heat transfer involving collisions is called conduction, and air is a poor conductor of heat energy.</p> <p>D. Radiation describes the movement of heat through empty spaces.</p>

9. Which statement **best** describes wood and coal in terms of renewability and formation time?
- A. Wood is nonrenewable and forms in a few years, unlike coal, which is renewable and takes millions of years to form.
 - B. Wood is renewable and forms in a few years, unlike coal, which is nonrenewable and takes millions of years to form.
 - C. Wood is nonrenewable and takes millions of years to form, unlike coal, which is renewable and forms in a few years.
 - D. Wood is renewable and takes millions of years to form, unlike coal, which is nonrenewable and forms in a few years.

Item Information	
Alignment	S8.C.2.2.2
Answer Key	B
Depth of Knowledge	2
p-value A	16%
p-value B	70% (correct answer)
p-value C	7%
p-value D	7%
Option Annotations	<p>A. Wood is renewable, and coal is nonrenewable.</p> <p>B. Key: Wood is a renewable resource that forms rapidly compared to coal, which is nonrenewable.</p> <p>C. Wood is renewable, and coal is nonrenewable.</p> <p>D. Wood forms in a few years, and coal forms over millions of years.</p>

10. Fossils of extinct corals are commonly found in Pennsylvania. Scientists who study these coral fossils indicate that they are similar to living corals. Which statement **best** explains why these fossils provide valuable information about prehistoric Pennsylvania?
- A. They may indicate that the earliest settlers moved inland from the coasts and brought coral-based fertilizer for their crops.
 - B. They may provide evidence for evolution by comparing adaptations for living on land with aquatic adaptations in the same species.
 - C. They may indicate that corals may have lived on land at some point in history because corals presently live in aquatic environments.
 - D. They may provide evidence that Pennsylvania was once covered by warm ocean waters since most corals are presently found in these environments.

Item Information	
Alignment	S8.D.1.1.4
Answer Key	D
Depth of Knowledge	2
p-value A	9%
p-value B	16%
p-value C	13%
p-value D	62% (correct answer)
Option Annotations	<p>A. Materials in fertilizers are finely ground, making any fossils difficult to study.</p> <p>B. Extinct coral represent different species than living coral.</p> <p>C. Both extinct corals and living corals lived in aquatic environments.</p> <p>D. Key: Fossils of aquatic organisms found on land provide evidence to support the idea that water once covered the area.</p>

11. The acidity of the water in a stream is indicated by its pH. Historically, a certain stream has had a pH of 6.0. Acid rain has caused the stream’s pH to become 4.8. Which statement predicts how the stream’s ecosystem will **most likely** be impacted?
- A. The flow rate of the stream will increase.
 - B. The flow rate of the stream will decrease.
 - C. The number of fish in the stream will increase.
 - D. The number of fish in the stream will decrease.

Item Information	
Alignment	S8.D.1.2.2
Answer Key	D
Depth of Knowledge	2
p-value A	8%
p-value B	18%
p-value C	11%
p-value D	63% (correct answer)
Option Annotations	A. Flow rate is not directly related to the pH of a stream. B. Flow rate is not directly related to the pH of a stream. C. Changes to the pH of a stream will most likely harm organisms, like fish. D. Key: Fish and other stream organisms are likely harmed by a change in pH.

12. Which system contains water that is **most likely** to form a deep canyon?

- A. a river
- B. an ocean
- C. a wetland
- D. an estuary

Item Information	
Alignment	S8.D.1.3.3
Answer Key	A
Depth of Knowledge	2
p-value A	49% (correct answer)
p-value B	24%
p-value C	9%
p-value D	18%
Option Annotations	<p>A. Key: A river is a lotic (flowing) water system that erodes Earth materials and can result, over time, in the formation of a canyon.</p> <p>B. Movement of ocean water in currents or waves is unlikely to form a canyon.</p> <p>C. A wetland is a type of lentic (still) water system.</p> <p>D. An estuary is a type of lentic (still) water system.</p>

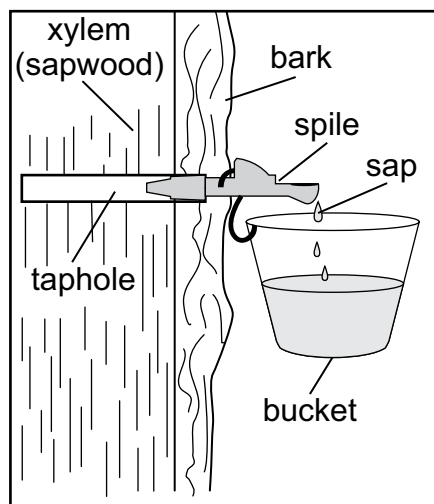
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Directions: Use the information presented on page 20 to answer questions 13 through 16.

Making Maple Syrup

In forested regions of Pennsylvania where maple trees are plentiful, making maple syrup is a time-honored tradition. When air temperatures are below freezing at night but above freezing during the day, the sap in maple trees begins to flow. This means that water, sugar, and minerals from the soil move upward through the xylem inside the trees. Xylem is a tissue in plants through which water and minerals move. Xylem also provides some structural support. Maple syrup makers access the sap by making a hole through the tree bark and into the outer area of xylem, commonly known as sapwood. They insert a spout, also called a spile, into this hole. This is called tapping the tree.

Tree-Tapping Diagram



Traditionally, maple tree sap was collected from buckets attached to the spiles. Maple syrup makers would visit each tree, sometimes several times a day, to empty the sap from each bucket into a larger collection container. Today, some maple syrup makers use a tubing system that allows sap to move from each tapped tree to a collection tank located where the sap processing occurs.

Processing the sap into maple syrup typically involves reducing water content by heating the sap in large pans. Once the liquid reaches a precise finishing temperature and density, it is maple syrup. It takes nearly 40 gallons of sap from maple trees to make 1 gallon of maple syrup.

13. Use the data table below to answer the question.

Approximate Boiling Points of Three Substances

Substance	Boiling Point (°C)
water	100
sap	104
maple syrup	107

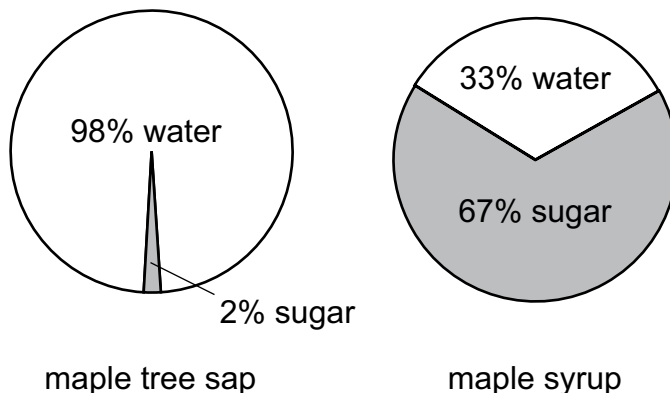
Which inference about the process of making maple syrup from maple tree sap is **best** supported by these data?

- A. As the concentration of sugar in the liquid increases, the boiling point increases.
- B. As the concentration of sugar in the liquid increases, the boiling point decreases.
- C. A decrease in the boiling point of the liquid causes a decrease in sugar concentration.
- D. A decrease in the boiling point of the liquid causes an increase in sugar concentration.

Item Information	
Alignment	S8.A.1.1.3
Answer Key	A
Depth of Knowledge	3
p-value A	60% (correct answer)
p-value B	14%
p-value C	16%
p-value D	10%
Option Annotations	A. Key: As the concentration of sugar increases in a liquid (maple syrup is simply sap without most of the water), the boiling point increases. B. Boiling point increases as the concentration of sugar in a liquid increases. C. Boiling point is the dependent variable; sugar concentration is independent. D. Boiling point is the dependent variable; sugar concentration is independent.

14. Use the graphs below to answer the question.

Properties of Maple Tree Sap and Maple Syrup



What is the approximate percent change in water content after maple tree sap becomes maple syrup?

- A. Maple tree sap has 2% less water than maple syrup.
- B. Maple tree sap has 34% less water than maple syrup.
- C. Maple tree sap has 31% more water than maple syrup.
- D. Maple tree sap has 65% more water than maple syrup.

Item Information	
Alignment	S8.A.1.3.1
Answer Key	D
Depth of Knowledge	2
p-value A	9%
p-value B	15%
p-value C	14%
p-value D	62% (correct answer)
Option Annotations	A. Maple tree sap has 2% sugar. B. This response incorrectly compares percentages in maple syrup. C. This response incorrectly compares percent water in maple syrup with percent sugar in maple tree sap. D. Key: At 98% water, maple tree sap has 65% more water than maple syrup.

15. Which internal structures in humans have the **most** similar functions to that of xylem in maple trees?
- A. lungs and skin, since they are involved in gas exchange
 - B. nerves and brain, since they respond to environmental stimuli
 - C. bones and muscles, since they are responsible for movement
 - D. veins and arteries, since they transport blood throughout the body

Item Information	
Alignment	S8.B.1.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	13%
p-value B	13%
p-value C	16%
p-value D	58% (correct answer)
Option Annotations	<p>A. Xylem moves water and minerals; it is not involved in gas exchange.</p> <p>B. Xylem moves water and minerals upward through a tree.</p> <p>C. Xylem provides some structural support, but it does not allow trees to move.</p> <p>D. Key: Similar to the movement of blood through veins and arteries, xylem helps move water and minerals upward through a tree.</p>

16. Tapholes for collecting maple syrup can scar the tree’s trunk. Why do the offspring of tapped maple trees, called saplings, have unscarred trunks?
- A. Scars are inherited traits, and saplings will develop scars as they age.
 - B. Scars are acquired traits, and saplings are unable to inherit acquired traits.
 - C. Scars are dominant traits, so a mutation must have occurred in saplings with unscarred trunks.
 - D. Scars are recessive traits, so a sapling must receive the traits from both parents to exhibit the trait.

Item Information	
Alignment	S8.B.2.2.1
Answer Key	B
Depth of Knowledge	2
p-value A	13%
p-value B	61% (correct answer)
p-value C	15%
p-value D	11%
Option Annotations	<p>A. Scars are acquired traits, not inherited.</p> <p>B. Key: Scars are acquired traits, which cannot be inherited.</p> <p>C. Scars are acquired traits; they are neither dominant nor recessive.</p> <p>D. Scars are acquired traits; they are neither dominant nor recessive.</p>

OPEN-ENDED ITEM

17. Meteor Crater is a rimmed, bowl-shaped feature that lies in the desert of northern Arizona. The crater measures 1,200 meters (m) in diameter, with the crater floor lying 180 m beneath the rim. The rim rises about 60 m above the surrounding desert. In the early twentieth century, most scientists theorized that the crater formed as a result of volcanic activity (volcanism theory). However, Daniel Barringer proposed that a powerful meteor impact formed the crater (impact theory).

Part A: Explain why the impact theory is classified as a theory rather than an opinion.

Part B: Barringer’s impact theory was eventually accepted by a majority of scientists. Describe what is needed for a new theory to become widely accepted by the scientific community.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



SCORING GUIDE

#17 Item Information

Alignment	S8.A.1.1.1	Depth of Knowledge	3	Mean Score	0.71
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Item-Specific Scoring Guideline

Score	Description
2	<p>The response demonstrates a <i>thorough</i> understanding of scientific theory. The response distinguishes between theory and opinion and explains how a theory is supported with evidence, or how new data/information may change existing theories and practices, by</p> <ul style="list-style-type: none"> • explaining why the impact theory is classified as theory rather than opinion <p>AND</p> <ul style="list-style-type: none"> • describing what is needed for a new theory to become widely accepted by the scientific community. <p>The response is clear, complete, and correct.</p>
1	<p>The response demonstrates a <i>partial</i> understanding of scientific theory. The response distinguishes between theory and opinion and explains how a theory is supported with evidence, or how new data/information may change existing theories and practices, by</p> <ul style="list-style-type: none"> • explaining why the impact theory is classified as theory rather than opinion <p>OR</p> <ul style="list-style-type: none"> • describing what is needed for a new theory to become widely accepted by the scientific community. <p>The response may contain some work that is incomplete or unclear.</p>
0	<p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p>

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit (responses are not limited to these examples):

Part A (1 point):

- It is a well-supported explanation that is widely accepted by the scientific community, and an opinion is a perspective only one person may hold
- It includes evidence, and is supported by facts, and an opinion is not based entirely on facts
- It is an explanation supported by many scientific observations over time, and an opinion may be formed with much less of a process, and in less time
- It may be modified many times if new evidence is uncovered and an opinion may not change in light of the same evidence
- It is subjected to the testing and questioning of others in the scientific community and an opinion does not require the same process
- other reasonable response highlighting the objective vs. subjective nature of theories and opinions respectively

Part B (1 point):

- thorough testing and experimentation by the scientific community
- an accumulation of evidence in support of the theory
- a time period of scientific dialogue among many experts in the field
- other reasonable description of the scrutiny involved in the acceptance of scientific theories

STUDENT RESPONSE

Response Score: 2 points



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Item ID

Next

Meteor Crater is a rimmed, bowl-shaped feature that lies in the desert of northern Arizona. The crater measures 1,200 meters (m) in diameter, with the crater floor lying 180 m beneath the rim. The rim rises about 60 m above the surrounding desert. In the early twentieth century, most scientists theorized that the crater formed as a result of volcanic activity (volcanism theory). However, Daniel Barringer proposed that a powerful meteor impact formed the crater (impact theory).

Part A: Explain why the impact theory is classified as a theory rather than an opinion.

Eq

There is considerable scientific evidence to support the impact theory, making it a theory. An opinion is biased and is not supported by much evidence if there is any evidence at all.

183 / 1000

Part B: Barringer's impact theory was eventually accepted by a majority of scientists. Describe what is needed for a new theory to become widely accepted by the scientific community.

Eq

Additional experimentation is necessary for a new theory to be acceted by the scientific community. The more evidence there is to support a theory, the more believable it will become.

183 / 1000

Review/End Test

Pause

Flag

Options

The response demonstrates a *thorough* understanding of scientific theory. The response distinguishes between theory and opinion and explains how a theory is supported with evidence, or how new data/information may change existing theories and practices. In Part A, the response explains why the impact theory is classified as theory rather than opinion: “*There is considerable scientific evidence to support the impact theory.*” In Part B, the response describes what is needed for a new theory to become widely accepted by the scientific community: “*Additional experimentation is necessary.*” The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 1 point



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Item ID

Line Guide

Meteor Crater is a rimmed, bowl-shaped feature that lies in the desert of northern Arizona. The crater measures 1,200 meters (m) in diameter, with the crater floor lying 180 m beneath the rim. The rim rises about 60 m above the surrounding desert. In the early twentieth century, most scientists theorized that the crater formed as a result of volcanic activity (volcanism theory). However, Daniel Barringer proposed that a powerful meteor impact formed the crater (impact theory).

Part A: Explain why the impact theory is classified as a theory rather than an opinion.

EQ 109 / 1000

Part B: Barringer's impact theory was eventually accepted by a majority of scientists. Describe what is needed for a new theory to become widely accepted by the scientific community.

EQ 104 / 1000

Review/End Test

Pause

Flag

Options

Next

The response demonstrates a *partial* understanding of scientific theory. The response distinguishes between theory and opinion and explains how a theory is supported with evidence, or how new data/information may change existing theories and practices. In Part A, the response “it is a theory because they don’t know if either of them are right and their just trying to find information” does not explain why the impact theory is classified as theory rather than opinion. The response is insufficient and does not receive any credit. In Part B, the response describes what is needed for a new theory to become widely accepted by the scientific community: “you need all the fact and information and evidence.” The response contains some work that is incomplete or unclear.

STUDENT RESPONSE

Response Score: 0 points

17. Meteor Crater is a rimmed, bowl-shaped feature that lies in the desert of northern Arizona. The crater measures 1,200 meters (m) in diameter, with the crater floor lying 180 m beneath the rim. The rim rises about 60 m above the surrounding desert. In the early twentieth century, most scientists theorized that the crater formed as a result of volcanic activity (volcanism theory). However, Daniel Barringer proposed that a powerful meteor impact formed the crater (impact theory).

Part A: Explain why the impact theory is classified as a theory rather than an opinion.

the impact theory is classified as a theory rather than an opinion. they call it something else so that no one knows what it is.

Part B: Barringer's impact theory was eventually accepted by a majority of scientists. Describe what is needed for a new theory to become widely accepted by the scientific community.

what is needed for a new theory to become widely accepted by the scientific community is you need to have a good idea. that is what you need for a new theory to become widely accepted by the scientific community.

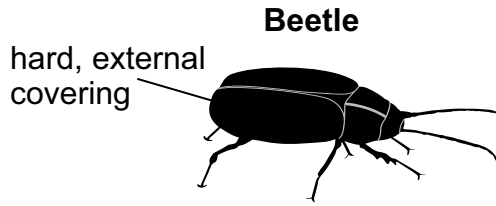
The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested. In Part A, the response "they call it something else so that no one knows what it is" does not explain why the impact theory is classified as theory rather than opinion. The response does not receive any credit. In Part B, the response "to have a good idea" does not describe what is needed for a new theory to become widely accepted by the scientific community. The response is insufficient and does not receive any credit.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



OPEN-ENDED ITEM

18. Use the drawing below to answer the question.



Beetles have a hard, external covering on their bodies.

Part A: Describe one function of the hard, external covering on the beetle.

Part B: Identify a human body structure and describe how its function is similar to the hard, external covering of a beetle.

Human Body Structure: _____

Similarity in Function: _____

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



SCORING GUIDE

#18 Item Information

Alignment	S8.B.1.1.2	Depth of Knowledge	3	Mean Score	1.38
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Item-Specific Scoring Guideline

Score	Description
2	<p>The response demonstrates a <i>thorough</i> understanding of similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular, nonvascular, single celled/multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape) by</p> <ul style="list-style-type: none"> • describing one function of the hard, external covering on the beetle and • identifying a human body structure and describing how its function is similar to the hard, external covering of the beetle <p>The response is clear, complete, and correct.</p>
1	<p>The response demonstrates a <i>partial</i> understanding of similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular, nonvascular, single celled/multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape) by</p> <ul style="list-style-type: none"> • describing one function of the hard, external covering on the beetle or • identifying a human body structure and describing how its function is similar to the hard, external covering of the beetle <p>The response may contain some work that is incomplete or unclear.</p>
0	<p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p>

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit:

Part A (1 point):

- Protection from and defense against predators
- Protection for internal organs
- Support for the beetle's internal structures
- A surface for muscle and other tissue attachment
- A barrier between internal and external environment
- other reasonable description of a function of a beetle's exoskeleton

Part B (1 point):

- The human chest cavity (sternum/rib cage) protects vital organs such as the heart and lungs
- The human skull protects the brain
- The human skeleton serves as a location for muscle and other tissue attachment
- The human skeleton serves as support for the rest of the body
- Human skin serves as a barrier between the internal and external environment
- other description of a human body structure that serves a similar role to the exoskeleton of a beetle

STUDENT RESPONSE

Response Score: 2 points



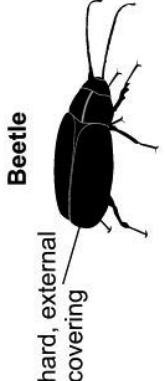
PART A

Question 18
Page 1 of 1

Item ID

Line Guide

Beetle



hard, external covering

Use the drawing below to answer the question.

Beetles have a hard, external covering on their bodies.

Part A: Describe one function of the hard, external covering on the beetle.

EQ

Beetle's hard external covering gives them shape and structure. The inside of their bodies are soft and vulnerable so it covers and protects them too. Some species of Beetles fly so when they bump into things they can bounce off and recover easily with damage to themselves. The beetles hard external covering is of vital importance to a small insect of pray.

357 / 1000

Next

Review/End Test

Pause

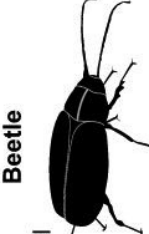
Flag

Options

PART B

Question 18
Page 1 of 1

Item ID



Beetle

hard, external covering

Line Guide

Use the drawing below to answer the question.

Beetles have a hard, external covering on their bodies.

Part B: Identify a human body structure and describe how its function is similar to the hard, external covering of a beetle.

Human Body Structure:

20/50

Similarity in Function:

Eq

Humans have a skeleton which is like a hard external covering but its on the inside. It gives us shape and structure and protects us from damage when we fall or bump into things or hurt ourselves. They inside of our bodies is soft and vulnerable and hold our vital organs. Our ribs protect our heart and lungs and our skull protects our brain. Our spine gives us strength and structure to stand with our backs upright.

510 / 1000

Review/End Test

Pause

Flag

Options

Back

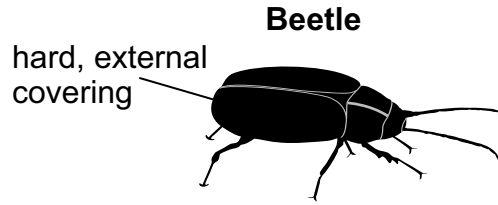
Next

The response demonstrates a *thorough* understanding of similarities and differences in internal structures of organisms and external structures of organisms. In Part A, the response correctly describes one function of the hard, external covering of the beetle: *“Beetle’s hard external covering gives them shape and structure”* OR *“it covers and protects them too.”* Either is correct for credit in Part A. In Part B, the response correctly identifies a human body structure and describes how its function is similar to the hard, external covering of the beetle: *“The skeletal system”* and *“It gives us shape and structure”* OR *“Our ribs protect our heart and lungs”* OR *“skull protects our brain”* OR *“Our spine gives us the strength and structure to stand with our backs upright.”* Any one of these examples provided in Part B would receive credit. The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 1 point

18. Use the drawing below to answer the question.



Beetles have a hard, external covering on their bodies.

Part A: Describe one function of the hard, external covering on the beetle.

it keeps it alive

Part B: Identify a human body structure and describe how its function is similar to the hard, external covering of a beetle.

Human Body Structure: *we have bones protecting out insides*

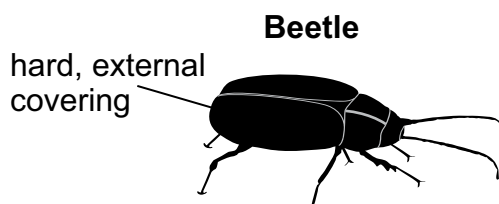
Similarity in Function: *bones protect the insides*

The response demonstrates a *partial* understanding of similarities and differences in internal structures or organisms and external structures. In Part A, the response “*it keeps it alive*” does not correctly describe one function of the hard, external covering of the beetle. This response is too vague and does not receive any credit. In Part B, the response correctly identifies a human body structure and describes how its function is similar to the hard, external covering of the beetle: “*bones*” and “*bones protect the insides.*” The response contains some work that is incomplete or unclear.

STUDENT RESPONSE

Response Score: 0 points

18. Use the drawing below to answer the question.



Beetles have a hard, external covering on their bodies.

Part A: Describe one function of the hard, external covering on the beetle.

Beetles are hard to live & (and)
deal with because they can live
in your walls or dirt or wood
pretty much anywhere.

Part B: Identify a human body structure and describe how its function is similar to the hard, external covering of a beetle.

Human Body Structure: Bones

Similarity in Function: heart
alot people lose stuff.

The response provides *insufficient* evidence to demonstrate any understanding of similarities and differences in internal structures of organisms and external structures of organisms. In Part A, there is no description of a function of the hard, external covering on the beetle and the response does not receive any credit. In Part B, the response does identify a human body structure ("Bones"), but there is not a valid description of how its function is similar to the function of the hard, external covering of the beetle. Part B does not receive any credit.

SAMPLE ITEM SUMMARY

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-values A	p-values B	p-values C	p-values D
1	S8.A.1.1.4	C	2	7%	4%	55%	34%
2	S8.A.2.1.1	C	2	11%	20%	62%	7%
3	S8.A.2.1.2	A	1	59%	27%	7%	7%
4	S8.A.2.1.5	B	2	9%	71%	16%	4%
5	S8.A.2.2.2	C	2	9%	17%	65%	9%
6	S8.A.3.2.2	A	2	63%	11%	10%	16%
7	S8.C.1.1.2	D	2	9%	14%	13%	64%
8	S8.C.2.1.2	B	2	12%	68%	7%	13%
9	S8.C.2.2.2	B	2	16%	70%	7%	7%
10	S8.D.1.1.4	D	2	9%	16%	13%	62%
11	S8.D.1.2.2	D	2	8%	18%	11%	63%
12	S8.D.1.3.3	A	2	49%	24%	9%	18%
13	S8.A.1.1.3	A	3	60%	14%	16%	10%
14	S8.A.1.3.1	D	2	9%	15%	14%	62%
15	S8.B.1.1.2	D	2	13%	13%	16%	58%
16	S8.B.2.2.1	B	2	13%	61%	15%	11%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	S8.A.1.1.1	2	3	0.71
18	S8.B.1.1.2	2	3	1.38

PSSA Grade 8 Science Item and Scoring Sampler

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